In these sentences, Mr. Hunter has embodied the principle on which is founded the whole practice of subcutaneous surgery; a principle of which, indeed, it seems hardly possible to exaggerate the importance. For, of the two injuries inflicted in a wound, the mechanical disturbance of the parts, and the exposure to the air of those that were covered, the exposure, if continued, is the worse. Both are apt to excite inflammation; but the exposure excites it most certainly, and in the worse form; *i. e.* in the form which most delays the process of repair, and which is most apt to endanger life. Abundant instances of this are shown in the difference between a simple and a compound fracture, though the former may have been produced by the greater violence; or, between a single fracture, even with much violence, extending into a joint, and an open wound, never so gently made into one. Or, for parallel instances, one may cite the rarity of suppurations after even extensive ecchymoses, and their general occurrence when wounds are left open.

I have lately had frequent occasion to observe these differences, in a series of experiments made for the illustration of the healing of divided muscles and tendons. Some of these were divided through open wounds, and some by subcutaneous section; and the present specimens afford a fair example of the difference of results that often ensued. In the same rabbit, the tibialis anticus and extensor longus digitorum were divided on the right side with a section through the skin; on the left with a subcutaneous section, through a small opening. Twelve days afterwards the rabbit was killed. The wound on the left side is shown well repaired, and with comparatively little trace of inflammation; the gap on the right is closed in with a scab, and an imperfect scar, but under these is a large collection of matter, and no trace of a reparative process. The contrast is the stronger, because in all these cases there is, unavoidably, more mechanical violence inflicted in the gradual subcutaneous division than in the simple open wound. And, it must be added, that a speedy closure of the external wound made in an open section may bring the case into more favourable conditions, than those of a subcutaneous wound made with more violence. This, also, I saw in some of the experiments: a clumsy subcutaneous division of one of Achilles-tendon excited great inflammation about it; while the open section of the other tendon in the same rabbit was quickly and well repaired, because the external wound had been speedily united, and had sufficiently soon converted the open into a subcutaneous injury.

Still, what Mr. Hunter said is true: subcutaneous wounds seldom inflame; open wounds generally both inflame and suppurate. It will be a principal object of this lecture to show something like an anatomical reason for this difference, in the fact that the materials produced for the repair of open wounds are not the same, or, at least, do not develop themselves in the same manner, as those for the repair of closed or subcutaneous ones.—*Lectures on the Processes of Repair and Reproduction after Injuries.—Lond. Med. Gaz.*, June, 1849.

31. *Modes of Healing of Open Wounds.* By James Paget, Esq.—The healing of open wounds may be accomplished by five different modes—namely, 1. By immediate union; 2. By primary adhesion; 3. By granulations; 4. By secondary adhesions, or the union of granulations; 5. By healing under a scab. The repair of subcutaneous wounds may be effected by immediate union, but is generally accomplished by connection, or the formation of bonds of union between the divided and retracted parts. Very rarely it is effected by means of granulations without suppuration. Of these modes, which I hope to describe hereafter in detail, it is the peculiarity of the first, or process of immediate union, that it is accomplished by the mere re-union or rejoining of the divided parts, without the production or interposition of any new material. In all the others, new material is produced and organized. This process of immediate union corresponds with what Mr. Hunter called "union by the first intention." It is not the same as that which, in modern surgery, is called union by the first intention; for that is the same as Mr. Hunter named "union by adhesion," or "by the adhesive inflammation;" and is effected, as he described it, by the organization of lymph interposed between two closely approximated wounded surfaces. Mr. Hunter maintained that, union by the first inten-

tion is effected by means of the fibrine of the blood extravasated between the surfaces of the injured part, which fibrine, there coagulating, adheres to both the surfaces, becomes organized, and forms a vascular bond of union between them.* Doubtless, Mr. Hunter was, in this, in error; but, as the blood extravasated in wounds is not without influence on their repair, I will endeavour to state the several modes in which it may, when thus effused, be finally disposed of.

In my last course of lectures, I stated the evidences for believing that masses of effused, or stagnant and coagulated blood may be organized; *i. e.* may assume the characters of a tissue, and may coalesce with the adjacent parts and become vascular. Among these evidences, several cases were mentioned in which such organization of blood had been distinctly traced; they included cases of blood effused in serous sacs, especially in the arachnoid, clots in veins organizing into fibrous cords, or, after less organization, degenerating into phlebolithes, clots organizing into tumours in the heart and arteries, and the clots so organized above ligatures on arteries as to form part of the fibrous cord, by which the obliterated artery is replaced. These last cases afforded the most conclusive evidence, because they had been very carefully investigated in a series of experiments and microscopic observations, by Dr. Zwicky.† In the course of last year, I had the opportunity of examining a specimen which, more fully than any other I had seen, confirmed his account of the mode in which blood-clots become organized. It supplied, too, some facts which appear to me important to the present subject.

The specimen was obtained from an insane person, by my friend Mr. Holmes Coote. A thin layer of pale blood-coloured and ruddy membrane lined the whole internal surface of the cerebral dura mater, and adhered close to it. Its colour, the existence of patches of blood-clot imbedded in it, and all its other characters, satisfactorily proved that it had been a thin clot of blood—an example of such as are effused in apoplexy of the cerebral membranes, of such as Mr. Prescott Hewett has so fully described in his paper in the Medico-Chirurgical Transactions. Numerous small vessels could be seen passing from the dura mater into this clot-membrane, and with the microscope, while they were still full of blood, I made a sketch from which the diagram was copied. The arrangement of blood-vessels bears a close resemblance, but, perhaps, more in its irregularity than in any positive characters or plan, to that which exists in false membrane formed of organized lymph: but the vessels were, I think, generally larger.

Such were the blood-vessels of this organized clot. Its minute structure showed characters which are of peculiar interest, because of their resemblance to those observed in the material that is commonly formed in the repair of subcutaneous injuries. In the substance of what else appeared like a filamentous clot of fibrine, sprinkled over with minute molecules, the addition of acetic acid brought into view corpuscles like nuclei, or cytoblasts, very elongated, attenuated, and, in some instances, like short strips of flat fibre. Of course, such corpuscles are not to be found in any ordinary clot of fibrine; neither are they seen in any stage of the organization of such lymph as is commonly effused in inflammation; but they exactly resemble such as may be found in certain examples of rudimental cellular tissue, and (among these) in the material for the repair of subcutaneous injuries. In short, the minute structure of this clot now organized, was an example of what I shall have often to refer to under the name of "nucleated blastema."

With such evidence as this of the organization of a thin layer of blood-clot, and of the development of its fibrine being apparently identical with that of the material commonly formed for the repair of subcutaneous injuries, it was with much surprise that I found that extravasated blood can, commonly, have no share at all in the repair of injuries.

One of the best proofs of this is, that scarcely the smallest portion of blood is effused in the cases in which the largest quantity of reparative material is produced in the shortest time, and in which the healing process was most perfectly accomplished. In twenty cases in which I have lately divided the Achilles tendon in rabbits, I have only once found, in the subsequent examinations, a clot of extravasated blood in the track of the wound. In this case, I believe, the posterior tibial artery was wounded; for in all others, and in similar divisions of muscles, unless a large arterial trunk, such as the anterior tibial, were cut, the only effusion of blood was in little blotches, not in separate clots, but effused or infiltrated in the cellular tissue near the wound. In some cases there was blood-stained infiltration of the inflammatory products, but in none were there such clots as could be organized into bonds of union. In short, parts thus divided scarcely bleed: what blood does flow escapes easily through the outer wound, as the surrounding tissues collapse into the space left by the retracting parts; or, what remains is infiltrated into the tissues, and forms no separate clot.

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* Works, vol. iii. p. 253.

† Ueber die Thrombus; Zurich, 1846.

It is the same with fractures. In a large proportion of these, one finds no clots lying between the fragments where they are to be united, and only very small spottings of blood, like ecchymoses, in or beneath the periosteum. The abundant extravasations that commonly exist in the subcutaneous tissue are generally confined to it: they are not continued down to the periosteum or bone.

In all these cases, then, we have sufficient proof that extravasated blood is not necessary for union by the first intention, or for any other mode of repair, in the simple fact that where the repair is best, and the material for it most ample, no blood is so extravasated as to form a clot that could be organized.

But, though this may be the usual case, the question still remains—When blood is effused between wounded surfaces, and clots there, how are the clots disposed of? For often, though not generally, such clots are found in wounds, or between the ends of a broken bone, or a divided tendon when an artery by its side is cut; and in most operation-wounds, one sees blood left on them, or flowing on their surfaces, after they are done up. How, then, is this blood disposed of?

If effused in large quantity, so as to form a voluminous clot, and especially if so effused in a wound which is not perfectly excluded from the air, or if effused in even a subcutaneous injury in a person whose health is not good, it is most likely to excite inflammation; and the swelling of the wounded parts, or their commencing suppuration, will push it out of the wound. Thus we often see blood ejected.

But in more favourable circumstances it may be absorbed; and this may happen whether it have formed separate clots, or, more readily, when it is infiltrated in the tissues. What I have seen, however, in the experiments to which I have already referred, leads me to dissent from the account commonly given of the absorption of blood thus effused. The expressions generally used imply that the first thing towards the repair of such a wound is the absorption of the extravasated blood; and that then, in its place, the lymph or reparative material is effused. But this can hardly be the case; for the absorption of blood is a very slow process, and commonly requires as much time as would suffice for the complete healing of a wound, or even of a fracture. Not to mention the very slow absorption of the extravasations of blood in apoplexy, or in serous sacs, I have found the blood effused in the subcutaneous tissue, and the muscles scarcely changed at the end of five weeks after a simple fracture; that in a tied artery as little changed after seven weeks; and even in common leech-bites we may sometimes find the blood-corpuscles in little ecchymoses unchanged a month after their extravasation: yet in much less time than this it is commonly implied that all the blood extravasated in an injury is cleared quite away, that lymph may occupy its place. My impression is, that this opinion rests on imperfect observations. Blood is supposed to be effused in all subcutaneous injuries; and where it is not found, it is supposed to have been absorbed; the truth, rather, being that, where no blood appears, none ever was.

The true method of the absorption of blood seems to be, that it is enclosed within the effused reparative material, and absorbed by the vessels of that material as its organization proceeds. The best instance in support of this, that I have seen, was in the case of an Achilles tendon divided subcutaneously six days before death. The reparative process had proceeded favourably, and as strong a band of union as is usual at that period was formed of the new reparative material effused between the retracted ends. On slitting open this band, I found within it a clot of blood, such as must have come from a large vessel; and this clot was completely enclosed within the new material, not closely adherent to it, nor changed, as if towards organization, but rather decolorized, mottled, and so altered as clots are in apoplexy before absorption.

I believe that this case only showed in a very marked manner what usually happens with blood thus effused and not ejected; for it is quite common, after the division of tendons, to find new reparative material, if not containing distinct clots, yet blotched with the blood that was infiltrated in the tissue in which the reparative material is deposited: and even when the repair of a fracture was nearly perfect, I have still found traces of blood-corpuscles enclosed in the reparative material, and degenerating, as if in preparation for absorption.

Ejection and absorption are, doubtless, the usual means by which blood effused in injuries is disposed of; yet I feel nearly sure it may in some instances become organized and form part of the reparative material. The cases of manifest organization of blood already referred to leave no doubt of the possibility of this happening: its occurrence can no longer be set aside as a thing quite improbable. The only question is, whether the organization of blood effused in injuries has been seen. Now I think no one familiar with Hunter's works will lightly esteem any statement of his as to a matter of observation. He may have been sometimes deceived in thinking that he saw blood becoming organized in subcutaneous injuries (for subcutaneous granulations are sometimes very like partially decolorized clots); yet I believe he was more often right: for sometimes one finds clots of blood about the fractured ends of bones which have every appearance of being in process of organization. They do not look mottled, or rusty, or brownish, as extravasated blood does when it is degenerating, preparatory to its absorption; but they are uniformly decolorized to a pinkish yellow hue. They have less appearance of filamentous structure than recent clots have, and they are not grumous or friable, like old and degenerating ones, but have a peculiar toughness, compactness, and elasticity, like firm gelatine. When clots are found in this condition, I believe it is a sign that they were organizing, for this is the condition into which, commonly, the clot in a tied artery passes in its way to be fully organized; and (which is very characteristic) you may find clots in the track of wounded parts thus changing, as if towards organization, while those about them, and out of the way of the reparative process, are degenerating.

On the whole, then, I believe we may thus conclude concerning the part that blood, when it is extravasated, takes in the repair of injuries:—

1. It is neither necessary nor advantageous to any mode of healing.
2. A large clot, at all exposed to the air, irritates and is ejected.
3. In more favourable conditions, the effused blood becomes enclosed in the accumulating reparative material; and while this is organizing, the blood is absorbed; and—

Lastly, it is probable that the blood may be organized and form part of the reparative material; but, even in this case, it probably retards the healing of the injury.—*Ibid.*

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32. *On the Alliances of Erysipelas.*—Dr. Gull read before the South London Medical Society (May 10th, 1849), a highly interesting and practically valuable paper on this subject.

Dr. Gull stated that in the year 1847, during the winter, his attention was first drawn to the complication of erysipelas with inflammation of the fauces. The disorder then prevailed to a great extent, and was very fatal; the same has shown itself during the present spring on two occasions, and particularly during the prevalence of easterly and north-easterly winds. The object of this communication is to point out the relation of several apparently different affections to erysipelas, and to discuss the general plan of treatment to be pursued.

To rest satisfied with the definition that erysipelas is an inflammatory affec-